Grand Baie, Rivière du Rempart District, Mauritius, Africa, wahoo, skipjack tuna, and mahi mahi

Small but mightily important

It's time to improve the management of ecologically and socially important small tunas

SMALL TUNAS, BONITOS, AND SPANISH MACKERELS (henceforth 'small tunas') play a crucial role in marine ecosystems. This group includes a variety of species whose habitats span tropical, subtropical, and temperate waters globally.

Small tunas often have an outsized role within marine food webs. They can be voracious predators that feed on a variety of smaller fish, crustaceans, and cephalopods but also can be key forage for predators, including sharks, marine mammals, seabirds, and larger fishes. This role, therefore, influences the population dynamics of other marine species, which means the health of their populations is important to the species they interact with and the broader health of the ecosystem.

Small tunas are caught within a variety of fisheries around the world. They are predominantly associated with smaller-scale commercial or artisanal operations, but some are caught in larger-scale industrial fisheries. In some fisheries, they are bycatch; and in others, they are economically and socially important - a source of income, food security, and

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livelihoods for fishing communities. They are caught and used for both human and animal consumption (e.g., byproducts that are used to produce feeds). Notwithstanding their importance, small tuna catches are typically not well monitored, and management of the fisheries that catch them as bycatch does not consider their status.

Figure 1. Small tunas play an important role in the marine ecosystem

THE CHALLENGE

Despite their size, small tunas are mighty important. Nevertheless, they are often overlooked as a lower priority for management than the main commercial tuna and billfish stocks that are managed by tuna regional fisheries management organizations (tRFMOs).

Small tuna stocks mostly straddle domestic coastal waters but can also be caught in oceanic waters. In some tRFMOs, such as the International Commission for the Conservation of Atlantic Tunas (ICCAT) and the Indian Ocean Tuna Commission (IOTC), small tuna species are included within their management mandate along with the more focal species (e.g., bluefin, skipjack, yellowfin, bigeye, and albacore). In other tRFMOs, such as the Western and Central Pacific Fisheries Commission (WCPFC) and the Inter-American Tropical Tuna Commission (IATTC), due to the nature of the fisheries for small tunas predominantly occurring in archipelagic and coastal waters, small tunas are often not considered key species for management, but some catch data is collected.

The catch of small tunas and their contribution to coastal economies can be substantial. Estimated catch of the main small tuna species reported in tRFMOs' catch statistics was

approximately 900,000 tonnes in 2022, estimated to be worth around US$1.3 billion at the first point of sale – **Table 1 and Figure 2**.

The catch reported to tRFMOs is around half of the total global fisheries catch of those same species (~1.8 million tonnes, worth ~US$2.6 billion), according to data reported to the FAO (FAO, 2024[1]). The difference in catch between tRFMO reported catch and FAO global capture statistics likely reflects the different mandates of tRFMOs to manage, monitor and report upon catches of small tunas. In the Western Pacific, most small tuna catch may occur in southeast Asian coastal archipelagic fisheries, which do not fall under the remit of WCPFC.

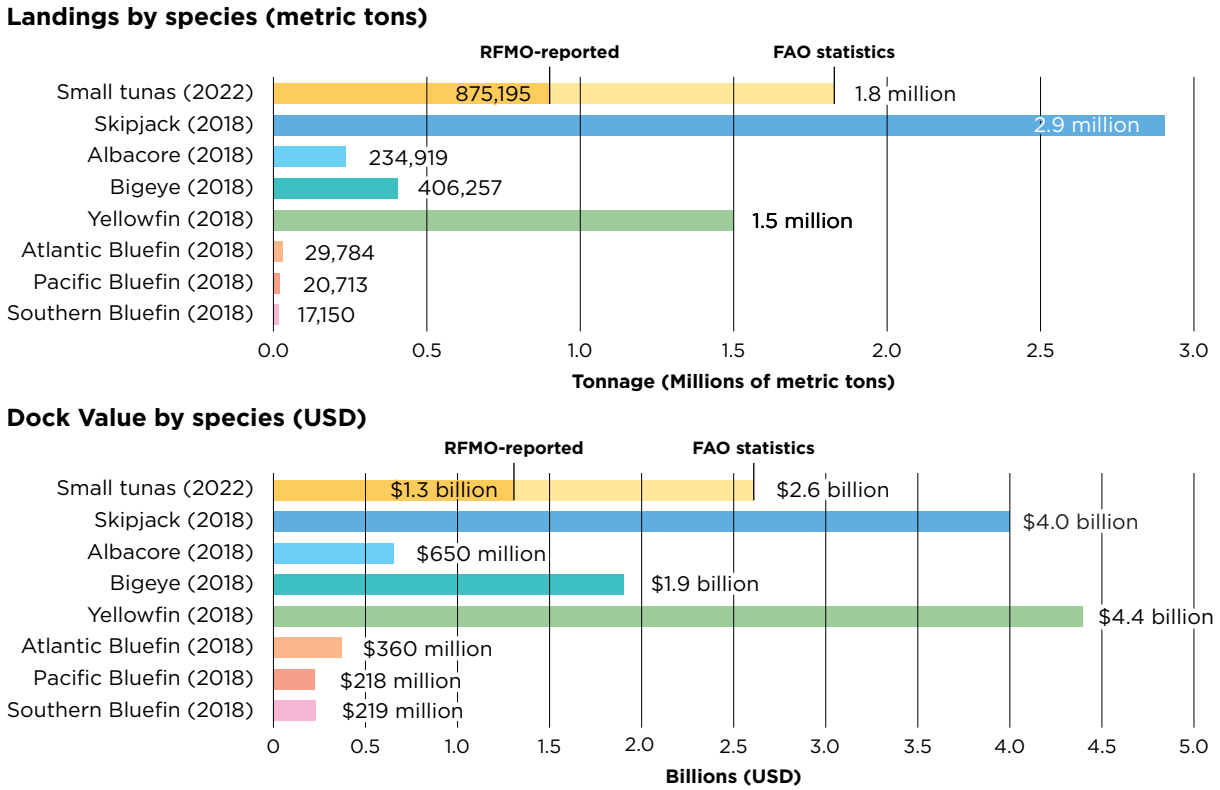

Figure 2. Volume and Value of Fisheries for Small Tunas vs. Main Commercial Tunas [2]

The representative price data for small tunas used to estimate the value of the reported catch in **Table 1** is considered highly uncertain and altogether missing for some fleets and oceans. However, it's clear that small tunas provide fishing communities and industry with an important source of income and food that should not be overlooked by management. More effort is required to connect the management of fisheries on small tunas that operate on the boundary between tRFMO regulatory areas and the coastal areas where other domestic or multi-lateral fisheries management mandates exist.

[1] Estimated using FAO 2024. Global Production. *In: Fisheries and Aquaculture*. Rome. https://www.fao.org/fishery/en/collection/global_production?lang=en

[2] Netting Billions 2020, available for download at www.pewtrusts.org/tunavalue

Insufficient catch, biological data, and stock identity information also make conducting scientific assessments difficult and highly uncertain. In the tRFMOs with small tunas under their purview, this means science-based management is challenging, and in most cases, there are no directed management measures to sustainably manage even the most frequently caught small tuna stocks. ***How, then, can management authorities improve the sustainable and precautionary management of these stocks?***

MANAGEMENT PROCEDURES AS A SOLUTION

Management procedures (MPs) are a pre-agreed, science-based approach to managing a diverse array of fisheries. They set allowable fishing levels, such as catch or effort limits, based on an indicator of current stock status. When tested using management strategy evaluation (MSE), MPs could help achieve sustainable, precautionary, and ecosystem-focussed management of small tunas. Notably, there are MSE tools designed for situations where there are serious data limitations and other uncertainties, as is currently the case with most small tuna species.

MSE is a simulation-based tool used to evaluate the performance of different MPs under a variety of scenarios. If a candidate MP is successful in this simulated environment, it is likely to work in the real world. This can be particularly useful in data-limited contexts, as MSE allows scientists to test the performance and robustness of management approaches across a range of potential situations and uncertainties. The goal of an MSE is to find the MP that will have the best success at achieving the objectives, regardless of which situation comes to fruition.

Table 1. List of small tunas, status, estimated/reported catch by tRFMO & estimated value

tRFMO [I]	Species	Status in 2023 [II]	Reported catch in 2022 (tonnes) [III]	Estimated dock value (million USD) [IV]
ICCAT	**Frigate tuna** *(Auxis thazard)* 	?	18,452	14.8
	Bullet tuna *(Auxis rochei)* 	?	5,018	4.0
	Atlantic bonito *(Sarda sarda)* 	?	92,229	163.2
	Plain bonito *(Orcynopsis unicolor)* 	?	146	0.1
	Little tunny *(Euthynnus alletteratus)* 	?	26,842	33.0
	King mackerel *(Scomberomorus cavalla)* 	?	8,731	11.5
	Wahoo *(Acanthocybium solandri)* 	?	4,391	9.5
	Atlantic Spanish mackerel *(Scomberomorus maculatus)* 	?	11,530	15.2
	West African Spanish mackerel *(Scomberomorus tritor)* 	?	1,710	2.3
	Serra Spanish mackerel *(Scomberomorus brasiliensis)* 	?	991	1.3

tRFMO [I]	Species	Status in 2023 [II]	Reported catch in 2022 (tonnes) [III]	Estimated dock value (million USD) [IV]
ICCAT	**Blackfin tuna** *(Thunnus atlanticus)* 	?	4,838	6.0
	Narrow-barred Spanish mackerel *(Scomberomorus commerson)* 	?	71	0.1
	Cero *(Scomberomorus regalis)* 	?	0	-
IOTC	**Narrow-barred Spanish mackerel** *(Scomberomorus commerson)* 	✗	168,167	222.0
	Kawakawa *(Euthynnus affinis)* 	✗	166,777	278.5
	Longtail tuna *(Thunnus tonggol)* 	✗	139,879	327.3
	Indo-Pacific king mackerel *(Scomberomorus guttatus)* 	✓	45,769	60.4
	Bullet tuna *(Auxis rochei)* 	?	20,794	16.6
	Frigate tuna *(Auxis thazard)* 	?	141,279	113.0
	Striped Bonito *(Sarda orientalis)* 	?	2,157	2.0
	Wahoo *(Acanthocybium solandri)* 	?	318	0.7
IATTC	**Black skipjack** *(Euthynnus lineatus)* 	?	6,462	7.9
	Bonitos *(Sarda spp.)* 	?	3,242	3.0
	Wahoo *(Acanthocybium solandri)* 	?	441 [V]	1.0
	Frigate & Bullet tuna *(Auxis thazard & Auxis rochei)* 	?	2,379	1.9
WCPFC	**Frigate & Bullet tuna** *(Auxis thazard & Auxis rochei)* 	?	35	0.03
	Kawakawa *(Euthynnus affinis)* 	?	25	0.04
	Wahoo *(Acanthocybium solandri)* 	?	2,522 [V]	5.4
		TOTAL	**875,195**	**$1,301**

[I] Some small tuna fisheries, including important mackerel fisheries, are under jurisdictions outside of the tRFMOs. These species and their catches are not covered here.

[II] ? Unknown
✗ Overfishing & Not Overfished or Not Overfishing & Overfished
✓ Not Overfishing & Not Overfished
✗ Overfishing & Overfished

[III] Reported catch is likely an underestimate for listed RFMOs due to various data observation, collection and submission limitations - for more info refer to each RFMO catch data records, reporting and methods used.

[IV] Calculated using the lowest price per tonne value from a range of wholesale frozen bulk prices for species obtained through web search. Surrogate values were applied by type (e.g. tuna, bonito, Spanish/king mackerel, frigate/bullet) where species-specific prices were not available. Values are estimates and should be used with caution. Improved species-specific price information and catch information should be prioritized to improve the valuation of small tuna catch at tRFMO's and globally.

[V] Reported catch data for Wahoo are for the year 2020 for IATTC and 2021 for WCPFC longline and 2022 for WCPFC purse seine.

The first step is to define management objectives that set the vision for the future of the stock and fishery, defining what success looks like. These objectives can include targets for fishing levels and stock status, food security related objectives, as well as ecological objectives that can help move toward an ecosystem approach to fisheries management (EAFM). EAFM and the precautionary approach are particularly critical for small tunas due to their potential ecological importance and relatively unknown status, respectively.

Considering ecosystem objectives in MSEs for small tunas could help to operationalize EAFM, helping to move it from theory to implementation. At least one performance indicator is used to quantify each management objective to enable evaluation of the degree to which the objective is achieved. See **Table 2** for examples of potential management objectives for data-limited small tunas.

Table 2. Defining management objectives for small tunas

Objective Category	Management Objective
Safety	• To minimize the probability that the stock will fall below a given biomass limit reference point.
Abundance	• To achieve a level of abundance to optimize catch rates, as measured by catch per unit effort, for example, to ensure both stock health and fishery profitability.
Yield	• To maintain catches in targeted artisanal and subsistence fisheries at current levels to support food security and the livelihoods of coastal fishers.
Ecological	• To ensure sufficient forage for predators. • To cap bycatch at an acceptable threshold level.

Another key consideration is the type of management procedure that is most appropriate and feasible to develop given available data. There are two primary MP categories: model-based MPs, which use statistical models to estimate stock status (i.e. biomass, relative biomass), and empirical, which use simpler indicators often from fishery data or surveys to guide management action through the MP. Given the data-limitations on small tunas, it will be necessary for scientists to explore, on a case by case basis, what type of MPs are feasible and best.

Empirical MPs use simple rules based on observable abundance indices, such as catch per unit effort (CPUE). They have been shown to perform well versus more complex model-based MPs and can be much less data-intensive and time-consuming to run, understand, and implement than complex model-based MPs. However, empirical MPs require a minimum level of data inputs, and fishing effort data may be hard to obtain, especially for artisanal fisheries. In limited cases, it may be possible to develop model-based MPs for the small tunas, though it is likely that data-limited methods would need to be utilized (e.g., OpenMSE; DLMtool [3]).

[3] https://openmse.com/
https://www.datalimitedtoolkit.org/

Since small tunas sometimes school with other targeted species, it is also possible that MPs regulating the latter would also help to meet the management objectives for the small tuna species. Therefore, it may be possible to develop management objectives, performance indicators, and operating models for small tunas to include in MSEs for target species in cases where bycatch is the main source of small tuna mortality.

Given the dynamic nature of marine ecosystems, management must be flexible and adaptive, incorporating the latest scientific knowledge and monitoring data to adjust management as needed. MPs do just that as a form of adaptive management. Once adopted, each time the MP is run, the stock status indicator is updated, triggering the corresponding management action for that stock level. This reactive and adaptive management ensures that MPs can remain effective over the long-term, even under changing conditions, including those anticipated due to climate change.

FURTHER IMPROVING MANAGEMENT OF SMALL TUNAS

Many small tuna stocks are severely data limited, which presents significant challenges for science and effective management by tRFMOs.

In addition to developing MSE-tested MPs for small tuna stocks, some additional steps can be taken to improve the management of these fisheries over time:

- Fill critical information gaps – particularly in the Pacific Ocean and southeast Asian region – by improving data collection, monitoring, and reporting. MSE can also help prioritize future data collection by assisting managers in understanding the value of information to reduce uncertainty in management advice (i.e., which data are most influential).
- Use appropriate proxy information to inform management: In the absence of species-specific data, MSEs can use life history data from ecologically similar or related species as proxies to fill scientific information gaps or inform MP selection.
- Apply risk-based scientific assessments and management: Will help to prioritize which small tuna stocks to focus on, and which, if any, need additional precautionary management measures based on specific risks of overfishing and fishery impacts on ecosystems.
- When designing management systems, including MPs, for the main commercial tunas, consider applying EAFM principles to take fishery impacts on small tuna species into account.

CONCLUSION

The sustainable management of small tunas requires a proactive approach that accounts for their ecological roles and the complexities of marine ecosystems. For data-limited species, precautionary measures and adaptive management will be crucial to ensure the long-term health of their populations, the ecosystems they inhabit, and the coastal economies they support. MSE-tested MPs meet all of these requirements and should be developed for these species. Enhanced data collection and stakeholder engagement are vital components of this strategy, helping to build a more resilient and sustainable fishery management framework for the often overlooked but mightily important small tunas.

Small-scale artisanal fishing canoes in Ghana

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